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SILO 3 BEST MANAGEMENT PRACTICE WORK PLAN

1-6-92

WEMCO/DOE
WEMCO:P:92-008
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LETTER

[redacted]

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Westinghouse
Environmental Management
Company of Ohio

PO Box 398704
Cincinnati, Ohio 45239-8704

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WEMCO:P:92-008

January 6, 1992

Mr. R. E. Tiller, Manager
Fernald Office
U. S. Department of Energy
P. O. Box 398705
Cincinnati, Ohio 45239-8705

Dear Mr. Tiller:

SILO 3 BEST MANAGEMENT PRACTICE WORK PLAN

Reference: DOE-015-91, R. E. Tiller to W. H. Britton, "Action Memorandum: Silo 3", dated October 3, 1991

Enclosed is the Silo 3 Best Management Practice (BMP) Work Plan. The Silo 3 BMP Work Plan was required to be submitted to the DOE-FO within 90 days from the receipt of the Removal Action Memorandum dated October 3, 1991. This work plan excludes the scope of all actions that are included in the Silo 3 Expedited Removal Action which is currently underway.

If there are any questions, our point of contact is D. A. Nixon, ext. 6590.

Very truly yours,

W.F. D... for

W. H. Britton
President

DAN:lem

Attachment

c: w/attachment
R. B. Allen, DOE-FO
L. C. Bogar
D. J. Carr
J. R. Craig, DOE-FO
D. T. Edwards
H. H. Glassey
L. A. Heckendorn
R. W. Helmes
J. P. Hopper
D. A. Nixon
S. A. Radabaugh
W. G. Tope
R. C. Worsley

AR File
ERA Project File
Central File

w/o attachment
Y. G. Gale
K. C. Gessendorf

DW:92:0015B

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BEST MANAGEMENT PRACTICES

WORK PLAN

FOR

SILO #3

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

JANUARY 1992

Prepared by:

Westinghouse Environmental Management Company of Ohio
Cincinnati, Ohio

For:

The United States Department of Energy
Oak Ridge Operations Office

2780

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I. INTRODUCTION

The Metal Oxide Waste Storage Silo (Silo #3) is one of four silos that are remedial elements in Operable Unit 4 (OU4) at the Fernald Environmental Management Project (FEMP). (Refer to Appendix 1, Figure 1-1 and Figure 1-2 for location of silo.)

Silo #3 was constructed in 1952 to store calcined raffinate from the FEMP refinery operations. It is a free-standing prestressed and post-stressed concrete domed silo with an inside diameter of 80 feet and a straight-side height of 26 feet 8 inches. The walls are constructed of 8 inch thick concrete with a 0.75 inch thick gunite coating on the exterior. The domed roof tapers from 8 inches thick at the silo walls to 4 inches thick at the apex. The floor is 4 inch thick concrete over a layer of gravel. Below the gravel is a 2 inch thick layer of asphaltic concrete underlain by approximately 18 inches of compacted clay. (See Appendix 1, Figure 1-3, Cross-Section Through Silo #3).

A dust collection system mounted on the top of the dome was used to control emissions during the filling operation which was accomplished by pneumatically conveying the calcined uranium ore refinery slurries.

A Removal Site Evaluation (RSE) for Silo #3 was issued by the Department of Energy (DOE) consistent with 40 CFR 300.410. It was determined by the DOE, as the lead agency at the FEMP, that a removal action is not necessary to remediate Silo #3. However, DOE determined that there are sufficient radiological concerns from an ALARA and Best Management Practices standpoint to warrant the implementation of limited additional preventive measures at the silo. Later, upon inspection of the condition of the dust collector, DOE deemed that an Expedited Removal Action to remove the dust collector and to seal the resultant openings was warranted.

The scope of this Best Management Practices Work Plan is to implement the following recommendations:

1. Weatherproof the silo to retard further deterioration of the structure from exposure to the elements.

2. Provide for monitoring of the structural stability.

3. Erect fencing around the silo to restrict personnel access to the silo.

A Record of Decision (ROD), scheduled for June 1994, will identify the final remediation of the four silos in Operable Unit 4. Fifteen months after the ROD date, a substantial and continuous construction effort toward the final remediation must be initiated.

II. BACKGROUND

A. SUMMARY OF THE POTENTIAL THREAT

The RSE[1] of Silo #3 assessed the magnitude of the potential threat.

The RSE states that there is no evidence that there has been any significant release of material from Silo #3 or that there are any current releases. The principal contaminant in the dried stored material is 179 curies of Thorium-230. Other radionuclides present include: Ra-226, Pb-210, U-238, U-234, Th-232, Ra-228, Ra-224. There is some limited potential for eventual penetration of contaminants to ground water.

Estimates of radon flux by two independent investigators [2,3] concludes that the 20 pCi/m^2-sec. flux standard (NESHAP, Part Q) is probably exceeded. The estimated value is related to the estimated head space volume of the silo and the estimated average internal temperatures and their fluctuations and the homogeneity of the material.

Subjecting the Silo #3 materials to the standard EP Tox test showed that the maximum allowable concentrations for arsenic, cadmium, chromium, and selenium are exceeded.[4]

Structural analysis of Silo #3[5] concludes that:

> The base slab and walls at the time of investigation were stable under the existing static loads being applied to them and should continue to remain stable for approximately five to ten years.

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[1]U.S. Department of Energy, 1991, "Removal Site Evaluation Silo #3, Fernald Environmental Management Project, Fernald, Ohio."

[2]Lee Wan & Associates, Inc., 1990

[3]Borak, T. B., 1985 "Calculation of Radon Emission, Dispersion, and Dosimetry from K-65 Storage Tanks at the Feed Materials Production Center."

[4]US DOE, 1990 "Remedial Investigation Report - Operable Unit 4

[5] Camargo Associates, Ltd., 1986, "K-65 Silos Study and Evaluation for the Feed Materials Production Center," Volume 1, Sections I through IX.

The center 20-ft. diameter portion of the dome top is structurally unsound for a load greater than the existing static dead load, but no life expectancy was assigned to it.

Later in 1990, Bechtel[6] concluded that, based on a field investigation, the domes seem to be in good condition, exhibiting little distress or deterioration. Slight inconsistencies in concrete thickness and in the diameter of existing field measured steel reinforcements were judged to be the result of construction events.

The concern is that a partial structural failure of Silo #3 would result in a loss of its integrity that could lead to an airborne release. While the walls of Silo #3 have retained their structural integrity, the potential exists for dome failure and the dust collection system, which is currently being removed as an Expedited Removal Action, adds to loading on the dome.

An assessment of the magnitude of the potential threat was based on the analysis of three scenarios catastrophic failure (addresses earthquake and tornados), acute failure (cracking), and chronic failure (unabated long-term releases).[7]

A significant environmental release from Silo #3 is not anticipated during an earthquake although the silo can be expected to experience cracking. The likely failure mode under tornadic conditions would be a dome collapse. The scenario for potential for exposure due to a tornado assumed dome failure had already occurred. This potential would not be abated by any actions addressed in this work plan.

Scenario 2 in the RSE represented a conservative upper bound condition for release of particulates to escape unnoticed through cracks and partial dome failure. This scenario could be applied to any potential undetected releases through vent pipes. These releases could be controlled by weatherproofing and the sealing of the cracks and openings.

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[6] Bechtel National, Inc., 1990, "Study and Evaluation of K-65 Silos for the FMPC at Fernald, Ohio," Job No. 14501, prepared for U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, TN.

[7] A Probablistic Risk Assessment for the K-65 Silos at the FMPC", Nov 1990, FMPC/SUB-029 for Assessing Catastrophic Failure Modes.

B. RELATED ACTIONS

The Expedited Removal Action will accomplish the work described as follows:

> The dust collector is currently being removed intact. Encapsulation of the deteriorated portion of the hopper section has been completed.
>
> The various existing ports and manways were gasketed and mechanically secured to provide a gas tight seal around the designed openings on the dome.

C. ROLES OF THE PARTICIPANTS

The DOE is the lead agency for this action and will coordinate and execute this Best Management Practices Work Plan.

Westinghouse Environmental Management Company of Ohio (WEMCO), as the FEMP Management and Operating Contractor, is responsible for implementation of the limited additional preventive measures at the silo in a manner consistent with DOE orders and regulatory guidance.

D. BEST MANAGEMENT PRACTICE ACTION

The Silo #3 Action will consist of:

1. Weatherproofing the silo.

2. Provide for monitoring of the structural stability of the silo dome.

3. Provide a security fence around Silo #3.

E. INTEGRATION WITH THE REMEDIAL ACTION

These actions will occur prior to initiating the final remedial action for Operable Unit 4. Completion of this Best Management Practice Plan mitigates the potential for contamination of the surrounding soil which supports the remedial objectives for Operable Unit 4. Sealing Silo #3 to reduce uncontrolled radon releases will also reduce the background radon readings around the four silos in OU4. This action will improve the ability to assess the effectiveness of the bentonite cap being placed in Silos #1 and #2. Completion of this activity also mitigates the potential fugitive dust emission from an airborne release through dome cracks, which will be sealed. Structural monitoring of the dome will detect movement prior to dome failure, this will reduce the risks of exposure by providing a warning period prior to "sudden failure" or partial dome collapse.

III. SUPPORT ACTIVITIES

A. PLANNING ACTIVITIES

Activities to be undertaken prior to the actual site work are planning, training, design, and management of the removal actions. Included in this activity will be the preparation of detailed task listings and delineation of responsibilities to support the schedule given in Section VIII. These activities are required to render the area reasonably free of hazards to personnel and/or the environment until the RI/FS process has been completed.

B. ADDITIONAL DATA/STUDIES REQUIRED

Preliminary field inspections of Silo #3 were performed to verify the condition of the dome. Inspections included confirming the number of openings in the silo, opening sizes and configuration, visual observation of cracks, locations of cracks and spalled areas, and other relevant field conditions. This information will form the basis for documentation of the current conditions.

A technical analysis should be performed to determine the effects of thermal expansion on the dome. Meeting the objective of creating a gas tight seal of Silo #3 would necessitate assessing the potential load fluctuations caused by thermally generated pressure variations in the head space beneath the domed section. To this end, pressure and temperature sensors have been installed in the head space.

The radon flux of the silo should be recalculated if sealing the openings causes the silo to act as a pressure vessel. The present calculations assume the radon is emitted from the silo as a result of thermal expansion of the air in the headspace.

C. SPECIFIC DESIGN ACTIVITIES

After approval of this Work Plan, design efforts will be finalized for this Best Management Practice activity. Detail design drawings will be completed for weatherproofing, meteorological pressure relief system, and structural monitoring locations.

D. TRAINING REQUIREMENTS

All personnel involved will be trained in accordance with the Occupational Safety and Health Administration (OSHA) standards found in 29 CFR 1910.120 as specifically outlined in the Project/Task Specific Health and Safety Plan.

IV. FIELD ACTIONS

A. IMPLEMENTATION OF THE BEST MANAGEMENT PRACTICES ACTION

Implementation of this Best Management Practices Work Plan will be performed by FEMP Operations and Maintenance personnel. The installation and construction type activities, in addition to the maintenance activities, will be performed both by FEMP Maintenance personnel and outside subcontractors. Monitoring of the Silo #3 structural stability will be performed by FEMP Operations personnel with support from outside subcontractors.

The silo dome shall be subjected to a radiological survey before the initiation of any further activity.

The Radiation Work Permit, to be prepared at the initiation of the field work, will address the personnel protective clothing and equipment requirements.

No effort shall be made to remove any embedded anchors or grout from the dome. Anchor bolts should be flame cut or ground off to present a reasonably regular surface suitable for the application of a weatherproof coating.

The complete exterior surface of the dome and side walls totaling approximately 13,000 square feet shall be covered with a fluid applied elastomeric protective coating to seal the silo against further moisture intrusion and mitigate the erosive effects of weathering. The polyurethane coating, approximately forty (40) mils thick, shall be built up by a multiple pass spray application over relatively clean, dry surfaces.

The application of a weatherproof coating on the exterior of the silo will inhibit the potential flow of radon through any of the cracks in the structure. The space beneath the silo dome must be vented to prevent the creation of a pressure differential between the interior of the structure and the outside. Pressure fluctuations created by thermal expansion and contraction would cause flexing of the dome creating additional structural stresses. A barometric damper shall be applied to keep the pressure in the silo from going negative. Positive pressure control will require venting a portion of the contained air through a dryer and an activated charcoal filter to remove any potential airborne particulate or radon gas that might be generated within the silo. The capacity, configuration and location of the radon filtration system will be developed during the execution of the plan.

B. DISPOSAL PLAN

Any containers, applicators or solvents used in the application of the elastomeric coating may be considered to be RCRA waste and must be handled and disposed of in accordance to the applicable procedures and regulations. Material Safety Data Sheets (MSDS) will be required for coating information.

C. OPERATIONS AND MAINTENANCE

Silo #3 shall be physically inspected on six month intervals to determine the condition of the protective coating applied to the exterior of the silo. The periodic surface examination will encompass recording any propagation of the visible cracks in the dome.

V. SAMPLING AND ANALYSIS PLAN

Conduct a thorough visual inspection of the exterior surface of the silo wall and dome prior to the application of the weather proof coating. A permanent record shall be made to document the position of the areas of visible deterioration of the concrete structure (spalling and cracking). Each area shall be located on the surface of the dome and wall by measuring from permanently established reference points. Each location on the dome shall be plotted on a plan view drawing of the dome and each location on the wall shall be plotted on a developed elevation of the wall. The length and width of each crack and the length, width and average depth of each spalled area shall be recorded on the drawings. All noted areas of deterioration should be cleaned of loose and flaking concrete and prepared in accordance to manufacturer's recommendation prior to application of the coating.

Semi-annual inspections of the silo shall be made to determine any changes in the deteriorated area previously recorded. Measurements will be taken and recorded. These results will be compared with previous measurements and any changes shall be noted. Any new areas of deterioration will be recorded as described in the above paragraph. When merited, these areas will be repaired. Scheduled inspections provide an organized means of measuring the rate and extent of any further degradation of the concrete or coating.

Based on the recommendation of Bechtel National, Inc. (1990), periodic surveys shall be made to determine if a change occurs in the elevation of the top relative to the spring circle of the dome. The report also recommended installing instrumentation on the top of the silo wall to detect changes in its circumference. This program of routine surveying will provide data with which to predict the behavior of the dome and provide an early warning of further concrete degradation. The survey data shall be recorded and evaluated against recorded pressure and temperature data to interpret if dome behavior is a result of pressure fluctuations created by thermal expansion and contraction.

Since it is anticipated that the silo will crack after an earthquake or under tornadic conditions, additional inspections and surveys shall be conducted after such an event. The data will be evaluated against the established baseline data to determine the extent of any damage.

No life expectancy was attached to the silo other than an estimate of a five to ten year stability of the walls under existing static load. Based on this observation, and the fact that some of the original structural analysis data was derived from studies on the other silos due to their similarities, it is advisable to conduct additional, thorough, structural analysis using best available technology after a period of ten years if the monitoring data supports new testing and no further removal action has taken place.

VI. HEALTH AND SAFETY PLAN

A Health and Safety Plan has been prepared for the Silo #3 Removal Action. It will be reviewed and amended, if required, prior to the initiation of this Best Management Practice action. The amended plan shall identify, evaluate, and control all safety and health hazards. In addition, it will provide for emergency response for hazardous operations. The plan will be consistent with 29 CFR 1910.120 and the FEMP Site Health and Safety Plan. Safety documentation will be prepared according to FMPC-2116 topical manual, "Implementing FMPC Policies and Procedures for System Safety Analysis and Review System" and DOE/OR-901, "Guidance for Preparation of Safety Analysis Reports."

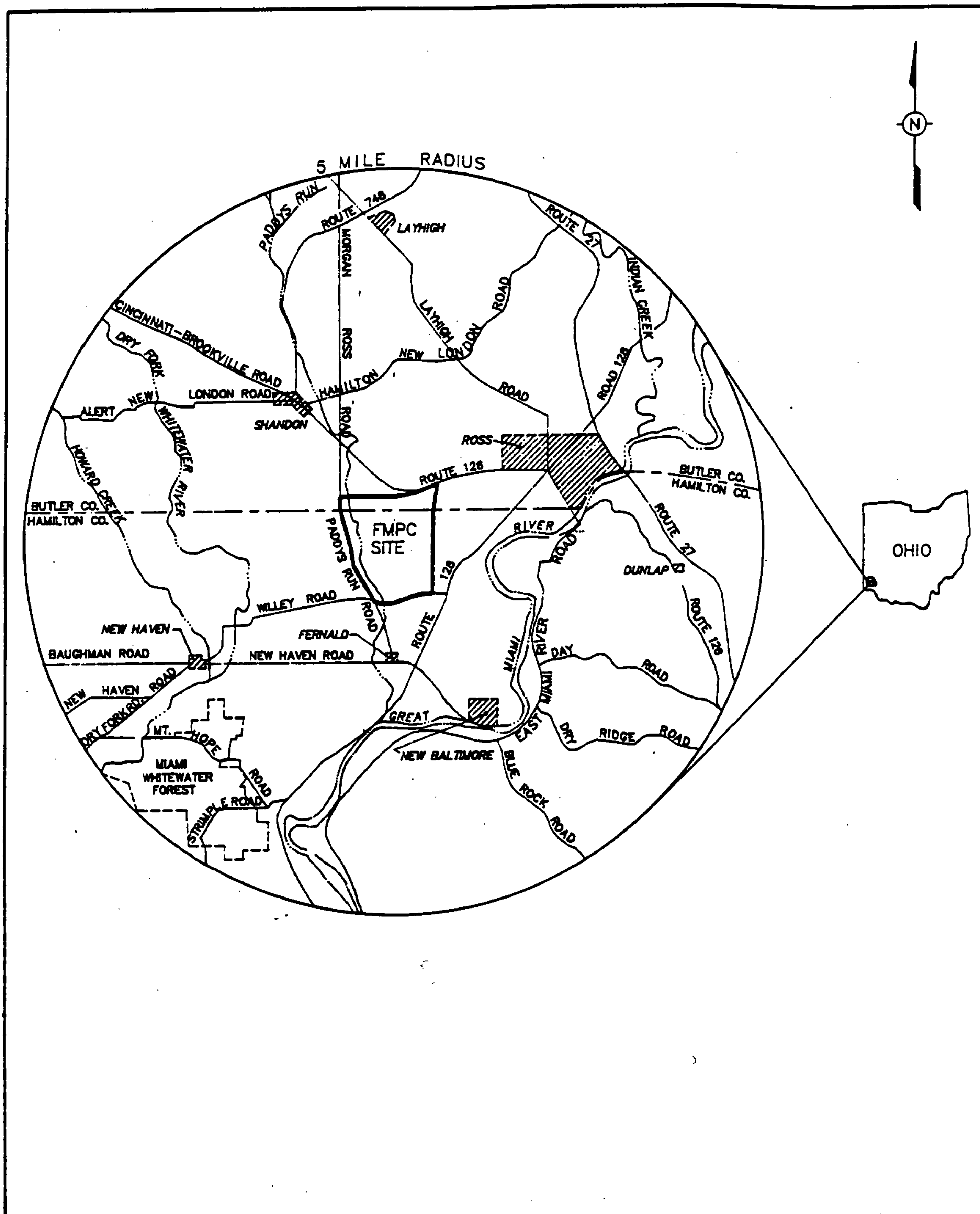
VII. QUALITY ASSURANCE

The Silo #3 action will be conducted according to requirements of the overall quality assurance program at the FEMP which is described in the site "Quality Assurance Plan," FMPC 2139. The "Quality Assurance Plan" is based on the criteria specified in ASME NQA-1, Federal EPA Guideline, QAMS-005/80 and DOE Orders 5700.6 and 5400.1. Specific quality assurance requirements will be incorporated into written and approved procedures and into personnel training. The Quality Assurance Department will conduct periodic surveillance to verify compliance.

VIII. SCHEDULE

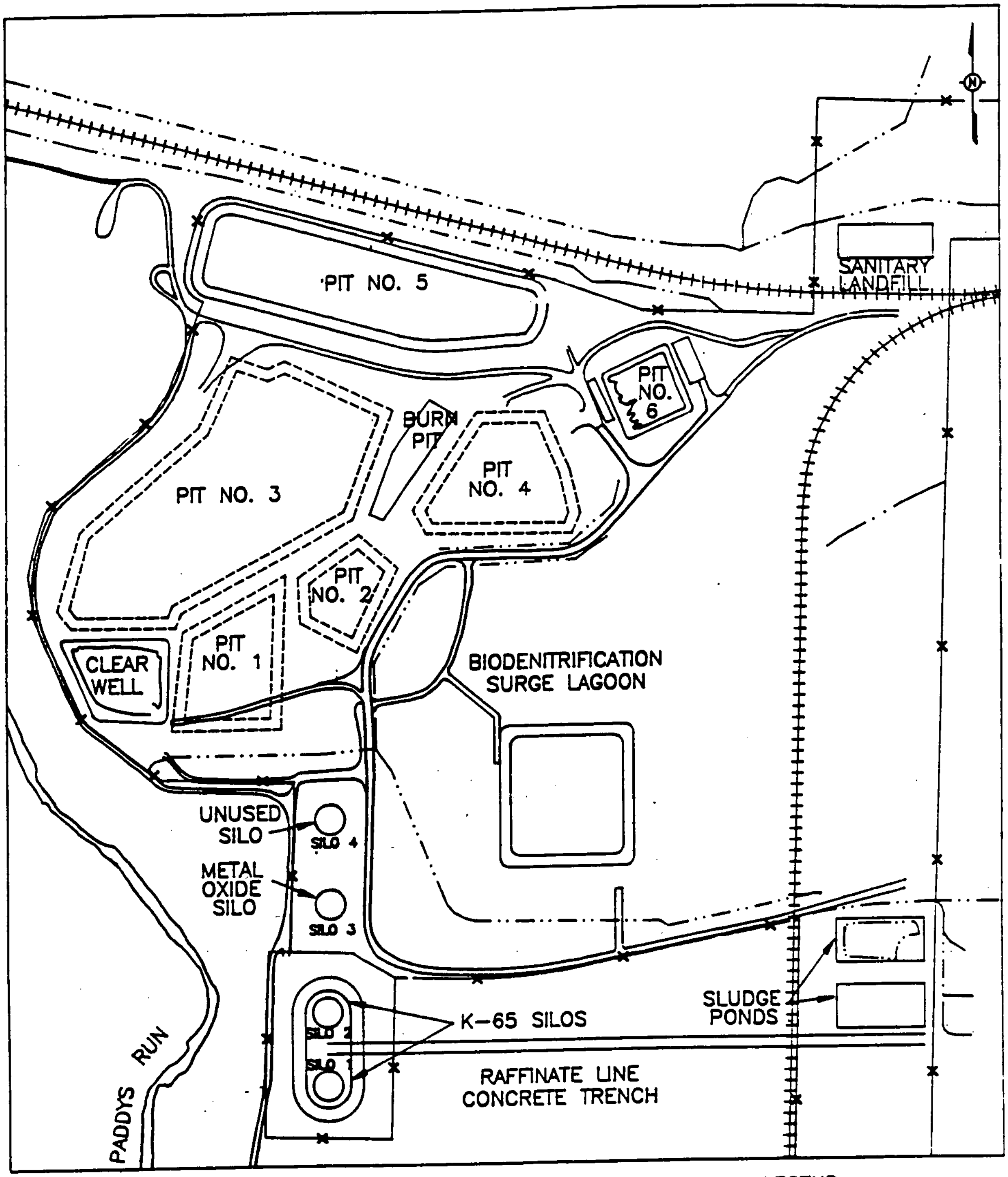
The work scope included in the Best Management Practices Work Plan will be initiated in Fiscal Year 1993 and is anticipated to take approximately five (5) months to complete the field activities. Monitoring for structural integrity shall be performed on a semi annual basis until remediation occurs.

APPENDIX 1



602.A_3317A146_BP_FND/OU4 TK12

FIGURE 1—1. FIVE MILE RADIUS MAP, FEED MATERIALS PRODUCTION CENTER



SCALE
0 175 350 FEET

NOTES:

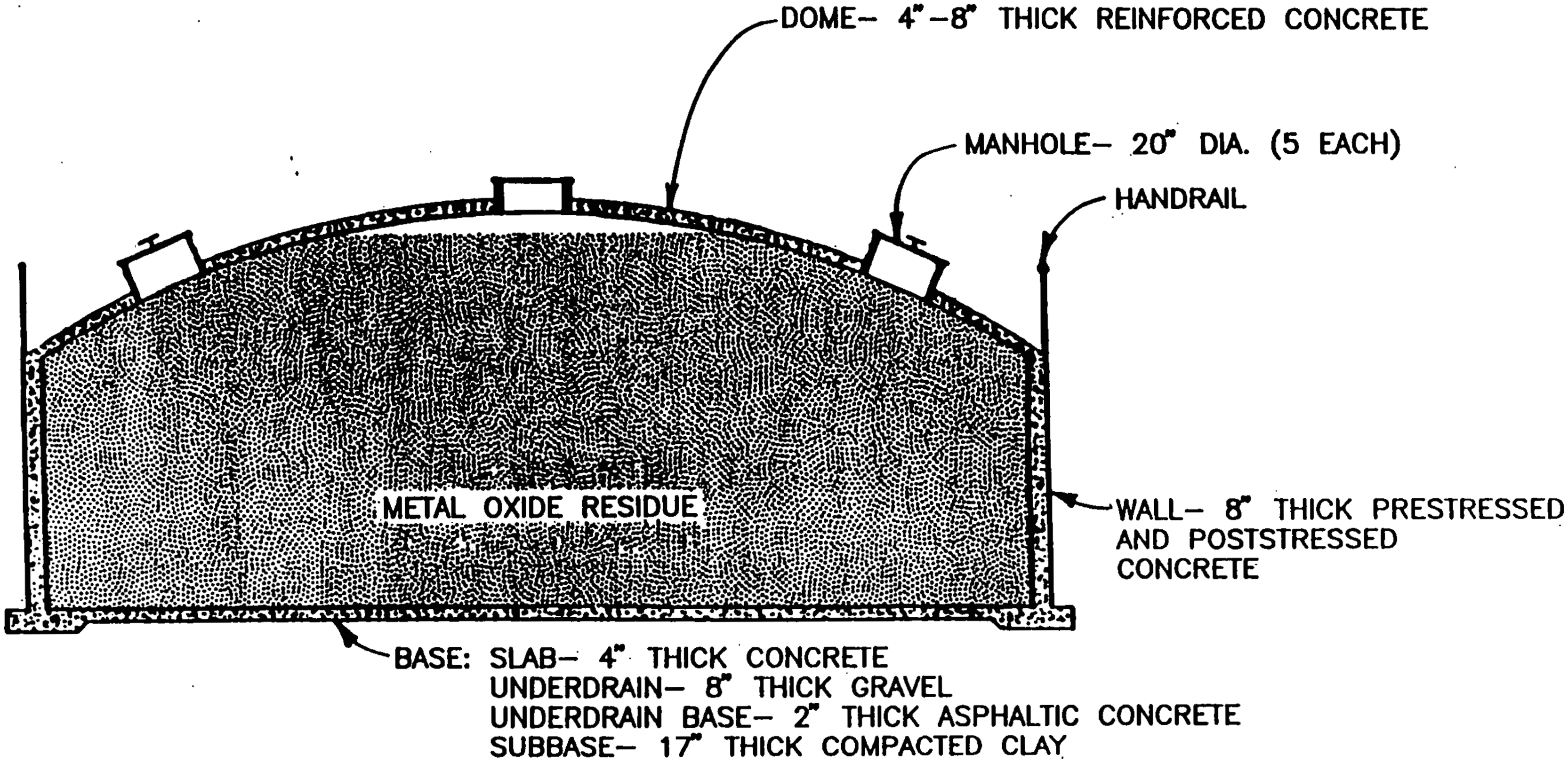
PITS 1, 2 AND 3 ARE COVERED
PIT 4 HAS AN INTERIM CAP

LEGEND:

- RAILROAD
- DRAINAGEWAYS
- FENCELINE
- ROADWAY

602_A_WPAREA_BP_FND/OU4 TK12

FIGURE 1-2. WASTE STORAGE AREA



NOT TO SCALE

FIGURE 1–3. CROSS–SECTION THROUGH SILO 3

303317-A-G29 OU4 TK 12 KNOX

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